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Project Consultant:	None appointed
Key Workers:	M S Taylor, Rothamsted Research S J Parker, Rothamsted Research C H Denholm, Rothamsted Research T Adamowicz, Rothamsted Research L J Alderson, Rothamsted Research M J Hall, Rothamsted Research T Kruger, Rothamsted Research J Waters, Rothamsted Research S J Wright, Rothamsted Research
Location of Project:	Rothamsted Research Harpenden Hertfordshire AL5 2JQ Tel: 01582 763133 ext. 2452 Fax: 01582 760981 Email: richard.harrington@bbsrc.ac.uk
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The results and conclusions in this report are based on an investigation conducted over three years. The conditions under which the work was carried out have been reported with detail and accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results especially if they are used as the basis for commercial product recommendations.

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GROWER SUMMARY

Headline

- March forecasts correctly predicted aphid first flights as early in 2002 and slightly early in 2003.
- Continuous monitoring detected significant outbreak of MACE insecticide resistance in the peach – potato aphid during autumn 2003.

Background and expected deliverables

Aphids can cause problems in every horticultural crop. Financial losses may be due to cosmetic damage or to yield loss resulting from removal of phloem sap or from viruses transmitted by the aphids. Some key aphid species of horticultural significance have clones which are resistant to a range of insecticides. Use of insecticides hastens the development of resistance and there is thus the need to reduce use to the minimum necessary. Such a strategy has many components, one of which is monitoring and forecasting which can help to optimise spray timings. Crop monitoring is time consuming, and can be guided by regional monitoring which does not involve growers.

The Rothamsted Insect Survey co-ordinates a network of suction traps in the UK for monitoring aphids. The long term and spatially extensive natures of the data facilitate forecasting of timing of migrations and abundance of a range of economically important species. Forecasts are driven mainly by temperature.

The objective of this project is to provide forecasts and up to date information on aphid species of importance in horticulture in a format that facilitates their use by growers. This allows improved targeting of surveillance and control measures. As the suction traps provide regional data, the objective is greatly enhanced by information from growers on aphid infestations in their crops (time of first sighting, size of infestations) which allows us to build up a picture of the extent of local variation in populations and how it relates to the regional data.

Summary of the project and main conclusions

Aphid monitoring

A series of aphid data bulletins was issued, listing 21 aphid species caught in suction traps throughout England and Scotland. These bulletins were accompanied by an aphid news sheet interpreting the figures relative to previous years. The raw data on aphids (including several that are pests of non horticultural crops) were also made available via the internet (www.rothamsted.bbsrc.ac.uk/insect-survey). General encyclopaedic information on the 21 aphid species is also now available on the internet pages (www.rothamsted.bbsrc.ac.uk/insect-survey/encylopaedicInfo), and the pages relevant to horticulture are reproduced in appendix 2. During 2001, 29 aphid data bulletins were issued, covering 15 suction traps; 19 of these bulletins were accompanied by aphid news sheets. In 2002, 32 aphid data bulletins were issued covering 16 suction traps; 18 of these bulletins were accompanied by aphid news sheets. In 2003, 30 aphid data bulletins were issued covering 15 suction traps; 17 of these bulletins were accompanied by aphid news sheets.

Aphid forecasts

Forecasts were provided in early March for the timing and size of spring migrations of the peach-potato aphid, potato aphid and cabbage aphid. Forecasts for the willow-carrot aphid were developed but they did not predict the timing of the migration far enough in advance to be useful. Attempts to develop sufficiently accurate forecasts for the currant-lettuce aphid were unsuccessful because of the low numbers trapped.

The 2001 growing season was preceded by a relatively cold winter with a significant number of frosts during January and February. A late start to aphid migration was predicted. This was confirmed and compounded by a cool and very wet May. A below average aphid year resulted, with only a few species flying in large numbers in June/July.

The 2002 season was preceded by a mild winter with relatively few hard frosts and an early aphid migration was predicted. This was realised for most species, resulting in large numbers in the early part of the year, but did not develop into high mid-season peaks due to suppression by natural enemies which also overwintered well.

The 2003 season was preceded by average temperatures in January and February, leading to a prediction of an average start to the aphid season in terms of timing of migrations and numbers in them. A remarkably warm and dry spring caused concern that these predictions may be overridden. This was the case in some places, with some very early activity, particularly in Scotland. Somewhat similar to 2002, relatively large numbers in the early part of the year did not develop into high mid-season peaks. This was again probably due to success of the natural enemies.

Summary of the 2001-03 growing seasons

1) <u>Cabbage aphid</u> – *Brevicoryne brassicae*

This aphid is a major pest of a range of brassicas, including broccoli, cabbage, cauliflower, kohl rabi, radish and swede. It causes serious feeding damage, leaving plants weakened and stunted. Less serious distortion and fouling of leaf surfaces reduce marketability. It can also transmit Cauliflower mosaic virus and Turnip mosaic virus. In most years there is just one distinct mid summer peak of migration in this species. The numbers recorded early in the year can indicate exceptionally large or small infestations. For the three years considered here numbers were generally well below normal, the only exception being a July 2001 migration in southern England.
The cabbage aphid overwinters mainly in the mobile stages on cruciferous crops and weeds, but not usually on kale, rape or turnips. A few may survive the winter as eggs on the same host plants.

2) <u>Willow – carrot aphid</u> – *Cavariella aegopodii*

This aphid is a major pest of carrots, celery, parsnips and parsley. It can be particularly serious in early sown (April/May) carrots. It transmits Carrot motley dwarf virus and Parsnip yellow fleck virus, both of which can cause severe stunting. The willow – carrot

aphid is an early flyer, with one large migration during a 5 – 6 week period from early May to mid June. Later flights are normally small and insignificant. This aphid was uncommon in 2001, because of a relatively cold winter combined with a prolonged wet May. However numbers returned to normal in 2002, with high numbers throughout the midlands in May, but stalling somewhat in June due to sustained predator pressure. The flight in 2003 was smaller, but also appeared to finish somewhat early, because the predator populations were well synchronised with the pest. The willow – carrot aphid overwinters as eggs on willow and in the active stages on various umbelliferous weeds.

3) Currant – lettuce aphid – *Nasonovia ribisnigri*

This is an important foliage aphid on lettuce, particularly in mid August/September. Rapid development of colonies on lettuce causes plants to become stunted and unpalatable, indeed even small numbers can contaminate plants and affect marketability. In some cases large populations on young plants can prevent 'hearting'. Numbers of this species caught in the suction traps are always very low, making trends or distinct migration periods difficult to identify. The yearly totals for 2001 and 2003 were close to normal, with 2002 slightly above normal. When compared to a ten year mean for England, the first flight in 2001 was 25 days later than average, whereas in 2002 and 2003 it was 20 days and 10 days earlier than average respectively. During late May/June winged aphids migrate from currants to lettuce and wild members of the daisy family. Successive generations are produced on these summer hosts until late September/October. During October/November winged aphids migrate back to currants where overwintering eggs are laid. In southern England mobile stages can survive and slowly reproduce on protected lettuce, chicory, hawkweed and speedwell throughout mild winters.

4) Potato aphid – *Macrosiphum euphorbiae*

In some years this species is a major pest on potatoes, and also on both indoor and outdoor lettuce. It is of less importance in the field as a virus vector, because of its relative inefficiency at transmitting viruses. Three migratory periods are discernible, the second (summer) migration being the largest. A small autumn migration occurs throughout the U.K. The small spring migration is concentrated in the south where overwintering is most successful. Large populations were recorded in the summer of 2001, particularly in the

eastern traps. An early start in 2002 failed to build and subsequent populations were well below normal. The 2003 flight was slightly larger and also started early during a warm dry spring, but large populations did not materialize. This aphid overwinters mainly as mobile stages on a wide range of weed species and, potentially, on potatoes in store and on protected lettuce. A few may pass the winter as eggs on roses.

5) <u>Peach – potato aphid</u> – *Myzus persicae*

This species is a major pest on potatoes, sugar beet, lettuce, brassicas and legumes. Its pest status is largely due to its wide host range and its proficiency in transmitting more than 120 plant viruses. The peach – potato aphid tends to fly slightly later than the potato aphid, but usually in larger numbers. Generally, numbers of this aphid during the last three years have not been exceptional, with just two summer hot spots at Wye, Kent in 2001 and Broom's Barn, Suffolk in 2003. As with the other species described, 2002 flights started particularly early, but populations failed to build, due to comparably early activity of predators and parasitoids. An interesting new observation has been a notable flight of this species in autumn 2002 and 2003, principally centred round the trap at Kirton, Lincolnshire, and may be related to a recent upsurge in insecticide resistant forms. This aphid has the added complication of exhibiting several forms of insecticide resistance. The levels of the esterase - based resistance to OPs and some carbamates have followed well established patterns during the last three years, with the numbers of the more resistant R2/R3 individuals increasing due to selection pressure as the year progresses. The MACE mechanism, which confers immunity to primicarb and triazamate, last seen in a significant outbreak in 1996 at Kirton, has reappeared. An outbreak in Scotland in 2001 on winter oilseed rape did not reappear in 2002. However, levels in England started to increase slowly in 2002, and climbed dramatically in 2003, again centred round the trap at Kirton. The 1996 MACE aphids were trapped in August, and were thought to originate from potatoes. The 2003 MACE aphids were trapped in late September/October, and were thought to originate from brassica crops. This aphid overwinters mainly in the mobile stages on a wide range of herbaceous plants, weeds and brassicas. Potentially they may also survive on potatoes in store and on protected lettuce. A few pass the winter as eggs on peach in southern Britain.

Financial benefits

The project:

- provides forecasts of the timing and size of aphid migrations nation-wide;
- provides easy access for growers and advisers to relevant information on current aphid pest status, insecticide resistance status and biology ;
- helps to facilitate focussed crop inspections prior to making control decisions;
- helps to facilitate optimal insecticide usage and hence reduce costs, limit selection for insecticide resistance and produce environmental benefits.

It is anticipated that a very small reduction in insecticide usage would be equivalent to the cost of the project. The cost-benefit relationship is enhanced dramatically by the synergistic funding of a range of organisations and core funding through the BBSRC and Lawes Agricultural Trust (total approximately £280,000 per year). It is difficult to cost environmental benefits.

Action points for growers

Check our weekly bulletins which you should receive by email together with an interpretation. These should act as a trigger to optimise crop inspections and possible control options. You can also access the data bulletin and background information about the aphids of horticultural importance via the web (www.rothamsted.bbsrc.ac.uk/insect-survey).

Please inform us (mark-s.taylor@bbsrc.ac.uk) of aphid occurrences in your crops and or any control failures, so that information which may be of use to the wider industry can be included in our weekly news sheets, and we can compare your local findings to our regional assessments and hence gradually improve interpretation of our regional data.

SCIENCE SECTION

Introduction

Aphids can cause problems in every horticultural crop. Financial losses may be due to cosmetic damage or to yield loss resulting from removal of phloem sap or from viruses transmitted by the aphids. Some key aphid species of horticultural significance (*Myzus persicae*, the peach-potato aphid and *Nasonovia ribisnigri*, the currant-lettuce aphid) have clones which are resistant to a range of insecticides (Barber *et al.*, 1999; Dewar *et al.*,1998; Rufingier *et al.*, 1997). *Macrosiphum euphorbiae* (the potato aphid), a pest of lettuce, is also showing signs of resistance. There is no *a priori* reason known why other species will not develop resistance in due course and there is no doubt that the greater the intensity of crop spraying, the greater is this risk, and the greater will be the problem from species already resistant. There is thus the need to reduce the use of insecticides to the minimum necessary. Such a strategy has many components, one of which is monitoring and forecasting, which can help to optimise spray timings. Crop monitoring is time consuming, and can be guided by regional monitoring which does not involve growers.

The Rothamsted Insect Survey (RIS) (Woiwod & Harrington, 1994), in collaboration with the Scottish Agricultural Science Agency, East Craigs, Edinburgh, operates a network of 16 suction traps in the U.K. for monitoring aphids. Daily records of most U.K. aphid species at these sites are available from up to 37 years ago to the present. The long term and spatially extensive natures of the data facilitate forecasting of phenology (timing of migrations *etc*.) and abundance of a range of economically important species. Forecasts are driven mainly by temperature.

A weekly bulletin is issued to contributors to the system, detailing numbers of 21 economically important species at each site. This includes the main species of relevance to the horticultural industry. In relation to specific contracts, forecasts and data interpretations are issued to the sugar beet industry. In Scotland, the data are used by SEERAD for forecasting the incidence of aphid-borne virus in seed potato crops. Prior to a Government review of `near market' research in 1989 a `commentary' was

issued with each aphid bulletin. This showed how the abundance of aphids associated with a particular crop compared to that at an equivalent time in the previous year and to a ten year mean. This basic interpretation of the data was found very useful by the industry but, following the review, could only be provided to those contributing to data collection. The funding of this project provides access to such information for HDC members.

Use of the information and forecasts will lower labour input by focussing the time for crop inspection prior to aphid control and, by reducing the number of insecticidal sprays required, provide environmental and marketing benefits.

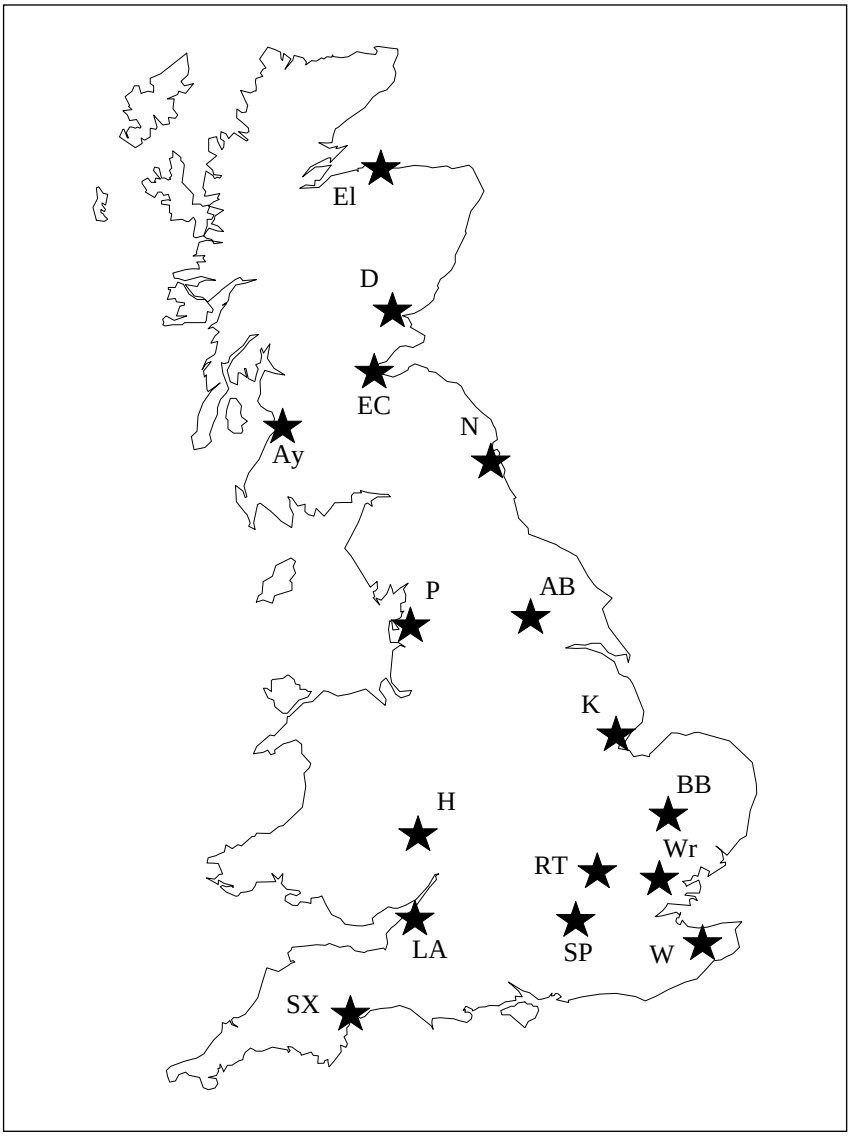
Materials and methods

Aphid monitoring

Fifteen suction traps (Macaulay *et al*., 1988) were operated throughout 2001, sixteen in 2002 and fifteen in 2003. Their locations are shown in Figure 1. Traps were emptied daily from April until mid November and weekly at other times. Samples from the traps in England were sent twice a week to Rothamsted Research and those from Scotland to SASA East Craigs, where the aphids were separated from other insects and identified to species or species group. A weekly bulletin incorporating data on 21 aphids of economic importance was sent by post to contributors and made available on a web site (www.rothamsted.bbsrc.ac.uk/insect-survey). For the traps in England, numbers of five species of horticultural importance (peach-potato aphid, potato aphid, cabbage aphid, willow-carrot aphid and currant-lettuce aphid) caught each week were compared to numbers caught over the same period in the previous year and to a ten year mean. This information was sent weekly by email from April through to August to the HDC for onward transmission to members. Growers were requested to provide information on aphid incidence in crops, and this was included, when received, in the weekly news sheets.

Figure 1

Suction Trap Sites



★ indicates suction trap sites which are:			
El	Elgin	BB	Broom's Barn
D	Dundee	H	Hereford
EC	East Craigs	RT	Rothamsted Tower
Ay	Ayr	Wr	Writtle
N	Newcastle	LA	Long Ashton
AB	Askham Bryan	SP	Silwood Park
P	Preston	W	Wye
K	Kirton	SX	Starcross

Aphid forecasting

Forecasts were issued during the first week in March 2002 and 2003, of the timing and size of migrations of peach-potato aphid, potato aphid and cabbage aphid.

The forecasts were based on simple linear regression equations relating, for peach-potato aphid and potato aphid, January-February mean temperature and, for cabbage aphid, December to February mean temperature, to the aphid variables. Forecasts were issued only where the relationships were statistically significant at $P<0.001$.

The forecasts take the form $y = ax + b$ where y is the variable to be forecast (julian date of first flight or $\log_{10}$ (+1) numbers caught up to July 1st for peach-potato aphid and potato aphid, October 7th for cabbage aphid), x is the mean temperature (January to February for peach-potato aphid and potato aphid, December to February for cabbage aphid), a and b are constants. (A full listing of the parameters for the 2002 and 2003 predictions can be found in the annual reports for 2001 and 2002.)

Development of forecasts for willow-carrot aphid

Work has continued to develop forecasts for the willow-carrot aphid. For all traps, regression equations for first record of the aphid and numbers caught ($\log_{10}(n+1)$) up to May 20th, June 17th and July 15th on mean temperature over individual months and all consecutive combinations of months from December to May, have been derived. Where the relationships are significant at $P<0.001$, forecast equations have been developed.

Development of forecasts for currant – lettuce aphid

Detailed statistical analysis for this species was attempted but proved very difficult because of the very low numbers caught in the suction traps.

Results and Discussion

Aphid monitoring

The raw aphid data bulletins listing weekly figures for 21 species can be viewed at http://www.rothamsted.bbsrc.ac.uk/insect-survey/. The weekly aphid news sheets and two newsflashes for 2003 are attached as appendix 1. The weekly aphid news sheets for 2001 and 2002 can be found in the annual reports for 2001 and 2002.

Summary of the 2001-03 growing seasons

1) **Cabbage aphid** – *Brevicoryne brassicae*

The trend formed by a ten year mean abundance is dominated by a very big flight in 1995. In most years there is just one distinct mid summer peak of migration in this species. The numbers recorded early in the year can indicate exceptionally large or small infestations. For the three years considered here numbers were generally well below normal, the only exception being a July 2001 migration in southern England. In 2001, first flight was 6 days later than average, whereas in 2002 and 2003 it was 10 days and 4 days earlier than average respectively.

2) **Willow – carrot aphid** – *Cavariella aegopodii*

The willow – carrot aphid is an early flyer, with one large migration during a 5 – 6 week period from early May to mid June. Later flights are normally small and insignificant. This aphid was very uncommon in 2001, because of a relatively cold winter combined with a prolonged wet May. However numbers returned to normal in 2002, with high numbers throughout the midlands in May, but stalling somewhat in June due to sustained predator pressure. The flight in 2003 was smaller, but also appeared to finish somewhat early, because the predator populations were well synchronised with the pest. In 2001, first flight was 19 days later than average, whereas in 2002 and 2003 it was 35 days and 21 days earlier than average respectively.

3) Currant – lettuce aphid – *Nasonovia ribisnigri*

Numbers of this species caught in the suction traps are always very low, making trends or distinct migration periods difficult to identify. The yearly totals for 2001 and 2003 were close to normal, with 2002 slightly above normal. In 2001, first flight was 25 days later than average, whereas in 2002 and 2003 it was 20 days and 10 days earlier than average respectively. During late May/June winged aphids migrate from currants to lettuce and wild members of the daisy family. Successive generations are produced on these summer hosts until late September/October. During October/November winged aphids migrate back to currants where overwintering eggs are laid. In southern England mobile stages can survive and slowly reproduce on protected lettuce, chicory, hawkweed and speedwell throughout mild winters.

4) Potato aphid – *Macrosiphum euphorbiae*

This species shows three discernible migrations, of which the largest occurs in summer. The small autumn migration occurs throughout the country. The small spring migration is concentrated in the south where overwintering is most successful. Large populations were recorded in the summer of 2001, particularly in the eastern traps. An early start in 2002 failed to build and subsequent populations were well below normal. The 2003 flight was slightly larger and also started early during a warm dry spring, but large populations did not materialize. In 2001 and 2003, first flight was 15 days and 2 days later than average respectively, whereas in 2002 it was 28 days earlier than average.

5) Peach – potato aphid – *Myzus persicae*

The peach – potato aphid tends to fly slightly later than the potato aphid, but usually in larger numbers. Generally, numbers of this aphid during the last three years have not been exceptional, with just two summer hot spots at Wye, Kent in 2001 and Broom's Barn, Suffolk in 2003. As in the other species described, 2002 flights started particularly early, but populations failed to build, due to comparably early activity of predators and parasitoids. In 2001, first flight was 20 days later than average, whereas in 2002 and 2003 it was 18 days and 2 days earlier respectively. An interesting new

observation has been a notable flight of this species in autumn 2002 and 2003, principally centred round the trap at Kirton, Lincolnshire, and this may be related to a recent upsurge in insecticide resistant forms. This aphid has the added complication of exhibiting several forms of insecticide resistance. The levels of the esterase - based resistance to OPs and some carbamates has followed well established patterns during the last three years, with the numbers of the more resistant R2/R3 individuals increasing due to selection pressure as the year progresses. The MACE mechanism, which confers immunity to pirimicarb and triazamate, last seen in a significant outbreak in 1996 at Kirton, has reappeared. An outbreak in Scotland in 2001 on winter oilseed rape, did not reappear in 2002. However, levels in England started to increase slowly in 2002, and climbed dramatically in 2003, again centred round the trap at Kirton. The 1996 MACE aphids were trapped in August, and were thought to originate from potatoes. The 2003 MACE aphids were trapped in late September/October, and were thought to originate from brassica crops.

Aphid forecasting

Forecasts were issued in the first week of March, at least six weeks before the first aphids of the species concerned were caught in the suction traps.

Predicted versus observed results for 2003

Table 1 shows observed and predicted dates of first capture and numbers caught at each trap site in 2003.

Table 1: Predicted (Pred.) and observed (Obs.) aphid migrations in 2003

(n/a = data not available)

Time of first capture

Trap	*M. persicae* (peach – potato aphid)		*M. euphorbiae* (potato aphid)		*B. brassicae* (cabbage aphid)	
	Pred.	Obs.	Pred.	Obs.	Pred.	Obs.
Rothamsted	May14	Apr 30	May16	Apr23	Jun5	May 2
Wye	May 16	May 4	No forecast		Jun 7	May 23
Broom's Barn	May 21	May 10	May 23	May 29	Jun 8	May 29
Newcastle	Jun 29	May 29	Jun 11	May 27	Aug 10	Jul 17
Dundee	Jun 15	Apr 21	May 30	May 27	No forecast	
Silwood	No forecast		May 3	Apr 16	No forecast	
East Craigs	Jun 16	May 29	May 26	Apr 10	No forecast	
Starcross	May 11	Apr 24	No forecast		May 14	May 22
Hereford	May 29	Apr 26	May 16	May 9	Jun 5	May 15
Preston	No forecast		May 22	May 19	Jul 8	Jun 4
Ayr	Jun 29	Jun 24	Jun 5	May 14	No forecast	
Writtle	May 2	Apr 25	May 2	Apr 24	May 20	May 24
Kirton	May 18	May 26	May 9	Apr 15	Jun 12	May 27

Numbers trapped to July 1st (*M. persicae* and *M. euphorbiae*) or October 7th (*B. brassicae*)

Trap	*M. persicae* (peach – potato aphid)		*M. euphorbiae* (potato aphid)		*B. brassicae* (cabbage aphid)	
	Pred.	Obs.	Pred.	Obs.	Pred.	Obs.
Rothamsted	27	96	19	10	123	270
Wye	33	143	23	20	124	412
Broom's Barn	29	506	10	37	No forecast	
Newcastle	2	7	No forecast		3	6
Dundee	3	7	6	21	No forecast	
Silwood	26	38	41	15	184	150
East Craigs	3	3	14	142	3	1
Starcross	11	38	28	39	No forecast	
Hereford	9	65	17	51	No forecast	
Preston	8	31	12	37	11	53
Ayr	1	1	5	12	No forecast	
Writtle	76	319	43	47	452	351
Kirton	12	56	30	28	133	109

A predicted average year was somewhat overridden by a remarkably warm and dry spring, which delivered earlier first flights than forecast, particularly in Scotland. On average these warm spring temperatures brought forward the flight of all three species by approximately two weeks. Numbers of the peach – potato aphid were higher than predicted in the south.

Predicted versus observed results for 2002

Table 2 shows observed and predicted dates of first capture and numbers caught at each trap site in 2002.

Table 2: Predicted (Pred.) and observed (Obs.) aphid migrations in 2002
(n/a = data not available)

Time of first capture

Trap	*M. persicae* (peach – potato aphid)		*M. euphorbiae* (potato aphid)		*B. brassicae* (cabbage aphid)	
	Pred.	Obs.	Pred.	Obs.	Pred.	Obs.
Rothamsted	Apr 9	Apr 1	No forecast		May 24	May 19
Wye	Apr 18	Apr 19	No forecast		May 22	Apr 27
Broom's Barn	Apr 20	Apr 23	Apr 29	Apr 15	Jun 2	May 16
Newcastle	Jun 7	Jun 22	May 28	May 23	Jul 31	Jul 10
Dundee	Jun 7	Jun 21	May 24	Jun 2	No forecast	
Silwood	No forecast		Apr 11	Apr 21	No forecast	
East Craigs	May 23	Jul 7	May 10	May 10	No forecast	
Starcross	Apr 10	Mar 25	No forecast		No forecast	
Hereford	Apr 27	May 17	Apr 25	Apr 22	May 25	May 18
Preston	No forecast		May 6	May 16	Jun 6	n/a
Ayr	May 29	Jul 5	May 16	May 25	No forecast	
Writtle	Apr 3	Apr 2	Apr 2	Apr 8	May 10	Apr 22
Kirton	Apr 27	Apr 23	Apr 23	Apr 23	May 30	May 27
Long Ashton	Apr 13	Apr 11	No forecast		May 19	May 15

Numbers trapped to July 1st (*M. persicae* and *M. euphorbiae*) or October 7th (*B. brassicae*)

Trap	*M. persicae* (peach – potato aphid)		*M. euphorbiae* (potato aphid)		*B. brassicae* (cabbage aphid)	
	Pred.	Obs.	Pred.	Obs.	Pred.	Obs.
Rothamsted	252	42	83	17	234	47
Wye	297	68	68	21	276	n/a
Broom's Barn	241	150	45	19	No forecast	
Newcastle	8	2	No forecast		5	n/a
Dundee	5	1	10	1	No forecast	
Silwood	134	16	177	12	No forecast	
East Craigs	12	0	38	37	9	0
Starcross	42	65	78	36	No forecast	
Hereford	78	27	65	17	423	70
Preston	47	9	47	5	26	n/a
Ayr	3	0	13	8	No forecast	
Writtle	699	105	190	21	1024	73
Kirton	59	17	91	21	240	61
Long Ashton	123	16	No forecast		92	n/a

Forecasts of date of first capture of peach – potato aphid were generally accurate in the south, but the aphid tended to appear later than predicted in the north. Forecasts of the date of first capture of potato aphid were generally accurate throughout the Country. Cabbage aphid tended to appear earlier than expected. Numbers caught were lower than expected for all species at all sites.

Development of forecasts for Willow – carrot aphid

Forecasts have been developed for the willow – carrot aphid. For all traps regression equations for first record of the aphid and numbers caught ($\log_{10}(n+1)$) up to May 20th, June 17th and July 15th on mean temperature over individual months and all consecutive combinations of months from December to May have been derived and are shown in Table 3 where the equations are significant ($P<0.001$). At most sites, it is necessary to know March temperature and, at many, April temperature. With first flights generally occurring in May, it is hence not possible to give such an early warning for this species as it is for the peach – potato aphid, potato aphid and cabbage aphid.

Table 3: Forecasts of time of first flight and abundance of Willow – carrot aphid

1st flight

	Months for temp (x)	Equation	% Variance accounted for
Rothamsted	Feb-Apr	y = -6.17x + 172.1	31.0
Wye	Jan-Apr	Y = -8.54X + 186.6	61.5
Broom's Barn	Mar-Apr	y = -8.64x + 200.4	52.4
Newcastle	Dec-Feb	y = -7.87x + 187.2	48.0
Dundee	Jan-Mar	y = -9.49x + 194.6	43.2
Silwood	Jan-Apr	y = -9.61x + 184.2	41.4
East Craigs	Dec-Mar	y = -12.12x + 194.7	57.1
Starcross	Jan-Apr	Y = -13.4x + 205.3	54.0
Preston	Jan-Feb	y = -8.60x + 165.1	69.3
Kirton	Jan-Apr	y = -11.4x + 198.2	64.1

Log_{10} Numbers to 20th May

	Months for temp (x)	Equation	% Variance accounted for
Rothamsted	Feb-Apr	y = 0.4338x – 1.8067	46.3
Wye	Jan-Apr	y = 0.4788x – 2.1567	62.1
Broom's Barn	Feb-Apr	y = 0.5363x – 2.4467	54.9
Dundee	Jan-Mar	y = 0.1232x – 0.3985	39.2
East Craigs	Jan-Feb	y = 0.1406x – 0.2847	42.1
Starcross	Feb	y = 0.2680x – 0.2625	47.0
Hereford	Feb-Apr	y = 0.4806x – 2.3728	55.9
Preston	Jan-Feb	y = 0.4325x – 0.8111	71.2
Writtle	Jan-Apr	y = 0.5697x – 2.3541	60.1
Kirton	Feb-Mar	y = 0.4104x – 1.3997	72.0

Log_{10} Numbers to 17th June

	Months for temp (x)	Equation	Variance accounted for
Newcastle	Dec-Mar	y = 0.3549x – 0.7046	54.7
Dundee	Dec-Apr	y = 0.5919x – 1.4521	48.2
East Craigs	Feb-Mar	y = 0.3561x – 0.3731	68.0
Ayr	Mar	y = 0.2821x – 0.7155	42.7
Kirton	Jan-Apr	y = 0.3980x – 0. 0836	46.4

Log_{10} Numbers to 15th July

	Months for temp (x)	Equation	Variance accounted for
Newcastle	Dec-Mar	y = 0.2270x + 0.5862	54.7
Dundee	Dec-Mar	y = 0.2952x + 0.1321	33.2
East Craigs	Dec-Mar	y = 0.2780x + 0.5239	51.3

Development of forecasts for the currant – lettuce aphid.

Numbers of this species caught in the suction traps proved too low to deliver forecasts of sufficient accuracy.

Conclusions

Feedback from recipients suggests that the weekly news sheets have been very useful. However, their use could be enhanced if more growers were able to supply current information on aphid incidence in their fields. These data would be particularly helpful in assessing the degree to which the time of first record in the suction traps matches that in crops. Reports of control failure would also be of use with regard to our monitoring of insecticide resistance levels in the peach – potato aphid.

Robust relationships between winter temperature and the timing and size of aphid migration in the spring exist for many species that overwinter as mobile individuals rather then as cold hardy eggs. Using these relationships, it is possible to predict by early March the timing and size of the spring migrations which are a threat to spring planted crops. The forecasts come before planting, aiding decisions as to the need for insecticidal treatments before sowing. Unusual conditions thereafter can sometimes affect accuracy, as in the exceptionally warm and dry March 2003. The factors determining aphid population levels are very complex. The current system is acceptably accurate in most years.

The outbreak of MACE insecticidal resistance in the peach – potato aphid during the autumn of 2003 caused considerable control problems in potatoes and vegetable brassicas in eastern England. This was the first significant epidemic in England since 1996, and highlights the need for continued vigilance in monitoring aphid populations both by suction trapping and field observation. It further confirms the paramount need for optimizing the timing of control applications, thus reducing unnecessary routine insurance spraying, that might cause environmental damage, select for resistant aphid clones and decrease gross margins.

TECHNOLOGY TRANSFER

2001

A paper by Collier, R., Harrington, R. and Tatchell, M. (2001) 'Forecasting aphid colonisation in outdoor salad crops' was given at the 6th International Aphid Symposium in Rennes, 3rd – 7th September 2001 (Abstract page 142).

29 aphid data bulletins were issued weekly between 4th May and 16th November and these were accompanied by 19 aphid news sheets between 20th April and 24th August.

2002

A demonstration of the work took place at the 2002 British Leafy Salads Association Conference, 13th November 2002, at the East of England Showground, Peterborough.

An article on the work was published in Grower magazine on December 12th 2002.

32 aphid data bulletins were issued weekly between 12th April and 15th November and these were accompanied by 18 aphid news sheets between 5th April and 9th August.

2003

A talk was given to the ADAS Vegetable Group at Kirton, Lincolnshire, on 12th February 2003.

30 aphid data bulletins were issued weekly between 25th April and 14th November and these were accompanied by 15 aphid news sheets between 25th April and 1st August, and two newsflashes issued in the autumn.

2004

An article summarising FV 238 entitled 'The fifteen towers – recent trends in aphid migration' appeared in the HDC news monthly journal.

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APPENDIX 1

APHID NEWS SHEETS and UPDATES

Aphid news 25th April 2003

Average temperatures in January and February led to a prediction of an average start to the aphid season in terms of the timing of migrations and numbers in them. However, the remarkably warm and dry spring weather has caused concerns that these predictions may be overridden. There are signs that this is happening in places, with some early activity, especially in Scotland. However, in general, current aphid activity is not yet remarkable for the time of year.

The first **peach - potato aphid**, *Myzus persicae*, was caught at Dundee on the 21st April. This was the earliest ever recorded at this trap and two months ahead of schedule. No other peach - potato aphids have been caught yet in suction traps, but one has drowned in Broom's Barns yellow water traps, showing that there is activity there even if below the threshold for detection using the suction traps.

The first **potato aphid**, *Macrosiphum euphorbiae*, was also recorded in 'tropical' Scotland, at East Craigs, Edinburgh during the week 7th – 13th April, some six weeks earlier than forecast. South of the border, this aphid has been recorded for the first time at Kirton, Lincs. on the 15th April and Silwood, near Ascot on the 16th April, which are 24 and 17 days, respectively, earlier than forecast, and about a week earlier than last year. The first water trap record of this species has been recorded at Broom's Barn on the 23rd April, a week later than last year.

There is no doubt that populations of both these species will be building up on a range of weeds and will take off before long. Indeed, drought conditions leading to poor quality host plants will encourage production of winged aphids. We will keep you up to date with developments.

The first **willow – carrot aphid**, *Cavariella aegopodii*, was trapped at Writtle, Essex on the 16th April and at Silwood on the 14th April. This is about 2 weeks earlier than average at Writtle, but about normal for Silwood.

We have not yet caught any **cabbage aphid**, *Brevicoryne brassicae*, or **currant – lettuce aphid**, *Nasonovia ribisnigri*.

A significant number of ladybirds have been noticed in local gardens during this warm spell, indicating natural enemies are also on the move early this year.

Actions: Be alert to the possibility of a somewhat earlier than forecast aphid season. Please feed back any information on aphids on crops when the time comes.

Mark-s.taylor@bbsrc.ac.uk and Richard.harrington@bbsrc.ac.uk

Mark S Taylor, Rothamsted Research
Richard Harrington, Rothamsted Research
Jon Pickup, SASA East Craigs
Rosemary Collier, HRI, Wellesbourne

Aphid news 2nd May 2003

Another spell of warm, dry weather resulted in an increase in the number of aphids in the suction traps during bulletin week 2: 21st - 27th April, but there are likely to be fewer this week as the weather turns wet and blustery. Aphids are flying earlier than forecast, but in most cases later than last year. The exceptionally warm spring has favoured their development and drought conditions are likely to have stressed their host plants, leading to a tendency of aphids to produce winged forms in order to escape substandard plants.

The following table shows species of horticultural importance which have appeared this week for the first time at specific sites, together with forecast dates where available, their time of first arrival last year, and the average time of their first arrival over the last ten years.

FIRST ARRIVALS	2003	Forecast 2003	2002	mean 93-02
Cavariella aegopodii **[willow-carrot aphid]**				
Wye	22-Apr	NA	19-Apr	7-May
Macrosiphum euphorbiae **[potato aphid]**				
Rothamsted	23-Apr	16-May	23-Apr	4-May
Writtle	24-Apr	2-May	8-Apr	12-Apr
Starcross	23-Apr	NA	15-Mar	18-Apr
Myzus persicae **[peach-potato aphid]**				
Hereford	26-Apr	29-May	17-May	19-May
Writtle	25-Apr	2-May	2-Apr	11-Apr
Silwood	22-Apr	NA	16-Apr	29-Apr
Starcross	24-Apr	11-May	22-Mar	3-May
NA = not available				

We have not yet caught any **cabbage aphid**, *Brevicoryne brassicae*, or **currant-lettuce aphid**, *Nasonovia ribisnigri*.

Actions: So far, the concern about a somewhat earlier than forecast season is justified, and vigilance is required. Please feed back any information on aphids in crops when the time comes. You can also view aphid data bulletin 2:21-27/4 at http://www.rothamsted.bbsrc.ac.uk/insect-survey/.

Mark-s.taylor@bbsrc.ac.uk and richard.harrington@bbsrc.ac.uk

Mark Taylor and Richard Harrington, Rothamsted Research
Rosemary Collier, HRI, Wellesbourne
Jon Pickup, SASA, East Craigs

Aphid news 9th May 2003

A period of wet and windy weather resulted in a slight decrease in the number of aphids in the suction traps during bulletin week 3: 28th April - 4th May. Aphids continue to fly earlier than forecast, but in most cases later than last year. The exceptionally warm spring has favoured their development, and the extended dry conditions are likely to have led to production of winged forms in order to escape substandard plants. When good flying conditions return, it should result in significant movement from the winter hosts.

The following table shows species of horticultural importance which have appeared this week for the first time at specific sites, together with forecast dates where available, their time of first arrival last year, and the average time of their first arrival over the last ten years.

FIRST ARRIVALS	**2003**	**Forecast 2003**	**2002**	**mean 93-02**
Cavariella aegopodii **[willow-carrot aphid]**				
Preston	30/4	NA	21/4	10/5
Myzus persicae **[peach-potato aphid]**				
Rothamsted	30/4	14/5	29/3	30/4
Wye	4/5	16/5	19/4	4/5
NA = not available				

The first **peach – potato aphids**, *Myzus persicae*, caught at Rothamsted and Wye were respectively some 14 and 12 days earlier than forecast, but both exactly on the 10 year mean.

We have not trapped any **potato aphid,** *Macrosiphum euphorbiae*, this week, and still have not caught any **cabbage aphid**, *Brevicoryne brassicae*, or **currant-lettuce aphid**, *Nasonovia ribisnigri* this year.

Actions: Flights of the peach potato aphid remain earlier than forecast, and vigilance is required. Please feed back any information on aphids in crops when the time comes. You can also view aphid data bulletin 3:28/4-4/5 at http://www.rothamsted.bbsrc.ac.uk/insect-survey/.

Mark-s.taylor@bbsrc.ac.uk and richard.harrington@bbsrc.ac.uk

Mark Taylor and Richard Harrington, Rothamsted Research
Rosemary Collier, HRI, Wellesbourne
Jon Pickup, SASA, East Craigs

Aphid news 16th May 2003

A period of more settled weather resulted in an increase in the number of aphids in the suction traps during bulletin week 4: 5th May - 11th May. Aphids continue to fly earlier than forecast, but in most cases later than last year.

The following table shows species of horticultural importance which have appeared this week for the first time at specific sites, together with forecast dates where available, their time of first arrival last year, and the average time of their first arrival over the last ten years.

FIRST ARRIVALS	2003	Forecast 2003	2002	mean 93-02
Brevicoryne brassicae **[cabbage aphid]**				
Silwood	7/5	NA	31/5	27/5
Cavariella aegopodii **[willow-carrot aphid]**				
Askham Bryan	7/5	NA	21/4	14/5
Kirton	7/5	NA	18/4	8/5
Broom's Barn	7/5	NA	15/4	9/5
Starcross	10/5	NA	26/3	24/4
Macrosiphim euphorbiae **[potato aphid]**				
Hereford	9/5	16/5	22/4	6/5
Wye	8/5	NA	18/4	2/5
Myzus persicae **[peach-potato aphid]**				
Broom's Barn	10/5	21/5	23/4	5/5
Nasonovia ribisnigri **[currant-lettuce aphid]**				
Kirton	6/5	NA	23/4	25/5
Starcross	7/5	NA	9/5	5/6
NA = not available				

The first **peach – potato aphid**, *Myzus persicae*, caught at Broom's Barn was 11 days earlier than forecast, and the first **potato aphid**, *Macrosiphum euphorbiae*, at Hereford some 7 days earlier than forecast. Low numbers of both *M.persicae* and *M.*euphorbiae, have been caught in the yellow water traps across the sugar beet growing areas, but with no obvious hotspots as yet.

The first **willow – carrot aphid**, *Cavariella aegopodii*, caught at Broom's Barn on the 7th May coincided nicely with a report from the field of the first *C.aegopodii* , found in celery crops in the Cambridgeshire Fens on the 8th May.

This week saw the first captures of both the **cabbage aphid ,** *Brevicoryne brassicae*, and the **currant-lettuce aphid**, *Nasonovia ribisnigri* this year. This is about 3 – 4 weeks earlier than the ten year means

Actions: Generally aphid flights remain earlier than forecast, and vigilance is required. Please feed back any information on aphids in crops when the time comes. You can also view aphid data bulletin 4: 5/5-11/5 at http://www.rothamsted.bbsrc.ac.uk/insect-survey/.

Mark-s.taylor@bbsrc.ac.uk and richard.harrington@bbsrc.ac.uk

Mark Taylor and Richard Harrington, Rothamsted Research
Rosemary Collier, HRI, Wellesbourne
Jon Pickup, SASA, East Craigs

Aphid news 23rd May 2003

A return to unsettled, wet and windy weather restricted the number of aphids in the suction traps during bulletin week 5: 12th May - 18th May. Aphids continue to fly during brief interludes of dry weather, but in most cases later than last year. The 2003 aphid figures accumulated up to the 18th May are below or well below the corresponding figures for 2002 and a 1993 – 2002 mean.

The following table shows species of horticultural importance which have appeared this week for the first time at specific sites, together with forecast dates where available, their time of first arrival last year, and the average time of their first arrival over the last ten years.

FIRST ARRIVALS	**2003**	**Forecast 2003**	**2002**	**mean 93-02**
Brevicoryne brassicae **[cabbage aphid]**				
Hereford	15/5	5/6	18/5	27/5
Cavariella aegopodii **[willow-carrot aphid]**				
Rothamsted	13/5	NA	20/4	8/5
Myzus persicae **[peach-potato aphid]**				
Askham Bryan	12/5	NA	13/4	25/5
Nasonovia ribisnigri **[currant-lettuce aphid]**				
Askham Bryan	12/5	NA	NA	11/7
Preston	17/5	NA	16/5	24/6
NA = not available				

The first **peach – potato aphid**, *Myzus persicae*, caught at Askham Bryan, Yorkshire was almost 2 weeks earlier than the ten year mean. Numbers of *M.persicae* have decreased in the yellow water traps across the sugar beet growing areas, and no virus has yet been detected in those individuals tested. No **potato aphids**, *Macrosiphum euphorbiae*, were caught in the suction traps this week.

The **willow – carrot aphid**, *Cavariella aegopodii*, was caught in all the English suction traps this week with the exception of Hereford and Newcastle.

This week saw the first captures of the **currant-lettuce aphid**, *Nasonovia ribisnigri* at Askham Bryan and Preston, some 6 – 8 weeks earlier than the ten year mean.

Actions: Watch the weather, there will not be much aphid flight until summer returns. The low accumulated figures suggest that where flights occurred earlier than expected, this will not translate into a major problem on crops. Please feed back any information on aphids in crops when the time comes. You can also view aphid data bulletin 5: 12/5-18/5 at http://www.rothamsted.bbsrc.ac.uk/insect-survey/.

Mark-s.taylor@bbsrc.ac.uk and richard.harrington@bbsrc.ac.uk

Mark Taylor and Richard Harrington, Rothamsted Research
Rosemary Collier, HRI, Wellesbourne
Jon Pickup, SASA, East Craigs

Aphid news 30th May 2003

An unsettled start to the week with some improvement over the bank holiday weekend, saw the number of aphids in the suction traps increasing during bulletin week 6: 19th May - 25th May. The 2003 aphid figures accumulated up to the 25th May remain below or well below the corresponding figures for 2002 and a 1993 – 2002 mean.

The following table shows species of horticultural importance which have appeared this week for the first time at specific sites, together with forecast dates where available, their time of first arrival last year, and the average time of their first arrival over the last ten years.

FIRST ARRIVALS	**2003**	**Forecast 2003**	**2002**	**mean 93-02**
Brevicoryne brassicae **[cabbage aphid]**				
Writtle	24/5	20/5	22/4	15/5
Wye	23/5	7/6	27/4	27/5
Starcross	22/5	14/5	23/4	8/5
Macrosiphum euphorbiae **[potato aphid]**				
Preston	19/5	22/5	16/5	14/5
Nasonovia ribisnigri **[currant-lettuce aphid]**				
Newcastle	25/5	NA	NA	10/8
Silwood	21/5	NA	12/5	29/5
NA = not available				

The **peach – potato aphid**, *Myzus persicae*, was flying throughout southern England with highest numbers at Writtle, Essex and Wye, Kent. The **potato aphid**, *Macrosiphum euphorbiae*, was caught for the first time at Preston, some three days earlier than forecast.

The **willow – carrot aphid**, *Cavariella aegopodii*, was caught in increasing numbers throughout England with the exception of Hereford.

The **cabbage aphid**, *Brevicoryne brassicae*, was caught for the first time at a further three of the southern traps. This aphid has also been reported arriving on young brassica crops in Lincolnshire over the weekend 24th/25th May.

This week saw the first captures of the **currant-lettuce aphid**, *Nasonovia ribisnigri* at Newcastle, some 8 weeks earlier than the ten year mean, and at Starcross just a week early.

Actions: The significant increase in temperature since the bank holiday should result in a marked increase in aphid reproduction and flight activity. Please feed back any information on aphids in crops. You can also view aphid data bulletin 6: 19/5-25/5 at http://www.rothamsted.bbsrc.ac.uk/insect-survey/.

Mark-s.taylor@bbsrc.ac.uk and richard.harrington@bbsrc.ac.uk

Mark Taylor and Richard Harrington, Rothamsted Research
Rosemary Collier, HRI, Wellesbourne
Jon Pickup, SASA, East Craigs

Aphid news 6th June 2003

A very warm week, for the time of year, saw aphid flights increase considerably during bulletin week 7: 26/5 – 1/6. The table below shows accumulated numbers for five species at traps in England for this year compared to last year and to a ten – year mean.

ACCUMULATED FIGURES UP TO WEEK 26/5-1/6 [* Silwood is only a three year mean 2000 - 02.]

	B.brassicae			C.aegopodii			M.euphorbiae			M.persicae			N.ribisnigri		
	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02
N	0	0	0	43	102	13	**12**	7	2	0	1	1	1	0	0
AB	0	13	19	**264**	258	130	0	12	7	**10**	7	4	1	0	0
P	0	0	2	184	176	277	5	4	8	2	3	5	3	2	2
K	2	6	31	91	627	273	3	18	14	15	9	15	2	3	2
BB	2	9	43	98	255	297	3	7	15	**48**	58	34	0	2	1
H	97	5	114	6	254	175	**21**	13	17	**17**	6	9	0	0	1
RT	7	8	33	33	194	139	4	12	13	13	21	31	0	2	1
WR	6	18	240	70	169	210	15	12	37	67	60	89	0	2	1
SP*	1	2	5	10	142	127	10	10	18	6	12	9	2	3	2
W	2	8	96	35	257	157	7	19	11	33	40	42	0	1	1
SX	8	9	19	9	166	168	13	27	15	**13**	31	8	3	2	1

The **peach – potato aphid**, *Myzus persicae*, sprung into action this week with over forty being caught at both Writtle and Broom's Barn. The first arrival at Kirton was eight days later than forecast. Most of the *M. persicae* tested up to 25th May are of the S or R1 esterase categories and should not present control difficulties. At Writtle there have been two R2s. This year we have not yet identified any MACE resistance types anywhere. The water trap figures from the sugar beet growing areas confirm a big increase in flight activity for *M. persicae*. The water trap figures for the **potato aphid**, *Macrosiphum euphorbiae*, did not increase from the previous week, but suction trap figures indicate a hot spot at Hereford.

The Lincolnshire field reports of **cabbage aphid**, *Brevicoryne brassicae*, were confirmed with further sightings of 'winged individuals plus 10 young on some early established brassicas'. There were suction trap first arrivals of this species at Kirton, Broom's Barn and Rothamsted this week, 16,10 and 8 days earlier than forecast. This species was also particularly numerous at Hereford this week.

Although not normally featured in this bulletin, exceptional numbers of the **leaf-curling plum aphid,** *Brachycaudus helichrysi*, may be of concern to those considering home-saved seed potatoes. This species is quite efficient at transmitting potato virus Y. Over 1000 were trapped at Broom's Barn alone, and many at all other sites.

Summary and actions: Monitoring all major aphid pests of field vegetables is now worthwhile. Please feed back any information on aphids in crops. You can also view aphid data bulletin 7: 26/5 – 1/6 at http://www.rothamsted.bbsrc.ac.uk/insect-survey/.

Mark-s.taylor@bbsrc.ac.uk and Richard.harrington@bbsrc.ac.uk

Mark Taylor and Richard Harrington, Rothamsted Research

Aphid news 13th June 2003

A warm sunny week interspersed with occasionally heavy showers, saw aphid flights continue to increase during bulletin week 8: 2/6 – 8/6. The table below shows accumulated numbers for five species at traps in England for this year compared to last year and to a ten – year mean.

ACCUMULATED FIGURES UP TO WEEK 2/6-8/6 [* Silwood is only a three year mean 2000 - 02.]

	B.brassicae			C.aegopodii			M.euphorbiae			M.persicae			N.ribisnigri		
	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02
N	0	0	0	**63**	133	21	**12**	9	3	0	2	2	1	0	0
AB	0	17	30	**323**	353	211	8	15	9	**16**	15	6	1	0	0
P	2	0	3	225	295	419	9	5	12	5	6	7	3	2	2
K	3	6	39	111	724	387	8	21	17	**22**	12	17	2	3	2
BB	6	15	67	110	349	364	3	12	18	**166**	92	47	0	2	1
H	122	7	149	7	346	249	**37**	17	21	**21**	20	14	0	0	1
RT	7	11	40	35	251	174	4	16	16	20	32	36	0	2	2
WR	9	23	306	81	195	246	19	18	45	105	87	114	0	2	1
SP*	1	3	7	10	171	148	11	12	19	8	16	11	2	3	2
W	19	8	106	47	308	197	8	20	14	39	47	56	0	1	1
SX	17	10	23	11	178	198	16	28	17	**22**	37	9	**4**	3	1

The numbers of **peach – potato aphid**, *Myzus persicae* continue to rise with a particular hotspot at Broom's Barn. The accumulated numbers are above the ten year accumulated means at Starcross, Hereford and throughout much of eastern England. Most of the *M. persicae* tested up to 1st June are of the S or R1 esterase categories and should not present control difficulties. However, 5 out of 7 tested at Kirton, Lincs were R2's, this suggests an upwards trend in the frequency of esterase based resistance in *M. persicae* in this region. Although somewhat early in the year, this probably reflects selection due to insecticide application (resistance frequencies tend to increase as each season progresses). Esterase confers resistance primarily to OP's and mono-methylcarbamates and some resistance to pyrethroids. Mercifully no MACE aphids have been found, so don't panic yet. The water trap figures from the sugar beet growing areas confirm a further big increase in flight activity for *M. persicae*. The water trap and suction trap figures for the **potato aphid**, *Macrosiphum euphorbiae*, did not increase much from the previous week, but suction trap figures still point to a hot spot at Hereford.

The numbers of **cabbage aphid**, *Brevicoryne brassicae*, in the suction traps remain somewhat low compared to field reports, with the exception of a relative hotspot at Hereford.

The numbers of **willow – carrot aphid**, *Cavariella aegopodii*, are above the accumulated ten year mean at both Newcastle and Askham Bryan,Yorks., but elsewhere are beginning to decline.

The **currant – lettuce aphid**, *Nasonovia ribisnigri*, was only caught at Starcross, Devon this week, where numbers are small but above the ten year mean.

Summary and actions: Monitoring all major aphid pests of field vegetables is now worthwhile, especially the **peach – potato aphid**, *M. persicae*, in eastern England. We will keep you informed as regards the resistance situation. Please feed back any information on aphids in crops. You can also view aphid data bulletin 8: 2/6 – 8/6 at http://www.rothamsted.bbsrc.ac.uk/insect-survey/.

Mark-s.taylor@bbsrc.ac.uk and Richard.harrington@bbsrc.ac.uk
Mark Taylor and Richard Harrington, Rothamsted Research
Rosemary Collier, HRI, Wellesbourne
Jon Pickup, SASA, East Craigs

Aphid news 20th June 2003

A changeable week, turning increasingly warm towards the weekend, resulted in intermittent conditions for aphid flight during bulletin week 9: 9/6 – 15/6. The table below shows accumulated numbers for five species at traps in England for this year compared to last year and to a ten – year mean.

ACCUMULATED FIGURES UP TO WEEK 9/6-15/6 [* Silwood is only a three year mean 2000 - 02.]

	B.brassicae			C.aegopodii			M.euphorbiae			M.persicae			N.ribisnigri		
	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02
N	0	0	0	**68**	146	29	**13**	9	4	1	2	3	1	0	0
AB	0	20	36	**331**	383	261	8	16	12	**22**	18	8	1	0	0
P	4	0	3	235	314	502	**15**	5	13	**9**	6	8	3	2	2
K	3	6	45	131	771	452	10	21	19	**34**	13	20	2	3	2
BB	14	17	85	116	494	421	7	13	23	**302**	97	66	0	2	1
H	**176**	7	164	7	397	287	**41**	17	23	**33**	23	18	0	0	1
RT	7	11	46	35	271	197	4	17	20	32	32	42	0	2	2
WR	21	26	481	91	223	284	25	20	53	**149**	90	147	0	2	2
SP*	1	4	11	10	178	163	13	12	22	12	16	12	2	3	2
W	23	8	115	61	323	226	14	20	17	53	57	76	0	1	1
SX	25	13	26	13	207	224	20	32	21	**22**	42	10	**4**	3	1

The numbers of **peach – potato aphid**, *Myzus persicae* increased slightly, with Broom's Barn remaining a very noticeable hotspot. The accumulated numbers are above the ten year accumulated means at Starcross, Hereford and throughout much of eastern England. The *M. persicae* tested up to 8th June were mostly of the S or R1 esterase categories and should not present control difficulties. However, the first MACE resistant aphids have been caught at Broom's Barn (4/46 for the week 2-8/6 were found to be R1 MACE aphids). These MACE forms are often reddish in colour and cannot be controlled by either pirimicarb or triazamate. Also one of the three *M. persicae* tested from Rothamsted showed R3 esterase resistance. The latest water trap figures from the sugar beet growing areas suggest a drop in flight activity for *M. persicae*. Both the water trap and suction trap figures for the **potato aphid**, *Macrosiphum euphorbiae*, did not change much from the previous week, but the accumulated suction trap figures at Hereford are above the ten year mean.

The numbers of **cabbage aphid**, *Brevicoryne brassicae*, in the suction traps remain low compared to some field reports, with the exception of a very distinct hotspot at Hereford.

The numbers of **willow – carrot aphid**, *Cavariella aegopodii*, continue to decline, and no **currant – lettuce aphid**, *Nasonovia ribisnigri*, were caught at all this week.

Both the **pea aphid**, *Acyrthosiphon pisum*, in central and southern England, and the **black – bean aphid**, *Aphis fabae*, in southern England increased noticeably in suction trap catches this week.

Summary and actions: Monitoring all major aphid pests of field vegetables is now worthwhile, especially the **peach – potato aphid**, *M. persicae*, in eastern England. Increased activity of aphid predators, in particular ladybirds, may be enough to counter resistant aphids in some crops. Please feed back any information on aphids in crops. You can also view aphid data bulletin 9: 9/6 – 15/6 at http://www.rothamsted.bbsrc.ac.uk/insect-survey/.

Mark-s.taylor@bbsrc.ac.uk and Richard.harrington@bbsrc.ac.uk
Mark Taylor and Richard Harrington, Rothamsted Research
Rosemary Collier, HRI, Wellesbourne
Jon Pickup, SASA, East Craigs

Aphid news 27th June 2003

A warm and windy week resulted in mixed conditions for aphid flight, but good conditions for aphid reproduction during bulletin week 10: 16/6 – 22/6. The table below shows accumulated numbers for five species at traps in England for this year compared to last year and to a ten – year mean.

ACCUMULATED FIGURES UP TO WEEK 16/6-22/6 [* Silwood is only a three year mean 2000 - 02.]

	B.brassicae			C.aegopodii			M.euphorbiae			M.persicae			N.ribisnigri		
	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02
N	0	0	0	**70**	161	42	**14**	12	6	2	2	5	1	0	0
AB	6	22	47	**339**	396	300	14	17	15	**28**	22	12	**3**	0	0
P	6	0	4	239	324	538	**23**	5	16	**11**	7	9	3	2	2
K	3	7	113	135	827	564	12	21	23	**48**	17	25	2	3	2
BB	22	24	151	124	608	479	19	15	28	**382**	143	99	0	2	1
H	**272**	7	189	9	432	321	**49**	17	31	**65**	27	25	0	0	1
RT	23	11	82	35	317	220	6	17	27	54	41	59	0	2	2
WR	73	28	739	93	245	316	33	20	65	**253**	101	228	2	2	2
SP*	5	6	17	10	192	174	15	12	24	**16**	16	12	2	3	2
W	37	8	145	71	336	263	20	21	24	85	62	93	0	1	1
SX	27	20	31	17	232	250	30	34	30	**28**	45	17	**4**	3	2

The numbers of **peach – potato aphid**, *Myzus persicae*, remain high throughout eastern England, Hereford and Starcross, with particular hotspots this week at Broom's Barn and Writtle. The *M. persicae* tested up to 15th June contained a further 6 MACE individuals (Broom's Barn 5/36 tested and Kirton 1/1 tested). Also one of the three *M. persicae* tested from Hereford showed R3 esterase resistance. The latest water trap figures from the sugar beet growing areas demonstrated a rise in flight activity for *M. persicae* (406 compared to previous week's 346). Both the water trap and suction trap figures for the **potato aphid**, *Macrosiphum euphorbiae*, did not change much from the previous week, but the accumulated suction trap figures at Newcastle, Preston and Hereford are marginally above the ten year mean.

The numbers of **cabbage aphid**, *Brevicoryne brassicae*, in the suction traps this week showed hotspots at Hereford and Writtle, but only at Hereford are the figures above the accumulated ten year mean.

The flight of the **willow – carrot aphid**, *Cavariella aegopodii*, has all but stopped, and the **currant – lettuce aphid**, *Nasonovia ribisnigri*, was caught only at Askham Bryan, Yorkshire and Writtle, Essex.

The **pea aphid**, *Acyrthosiphon pisum*, throughout England, and the **black – bean aphid**, *Aphis fabae*, in south west England continued to increase in the suction trap catches this week.

Summary and actions: Monitoring the **peach – potato aphid**, *M. persicae*, on a range of crops in eastern England is advised. There are reports of increased activity of both aphid predators (in particular hoverfly larvae) and aphid parasitoids, and this may be enough to counter resistant aphids in some crops. Please feed back any information on aphids in crops, and **especially any instances of control failure**. You can also view aphid data bulletin 10: 16/6 – 22/6 at http://www.rothamsted.bbsrc.ac.uk/insect-survey/.

Mark-s.taylor@bbsrc.ac.uk and Richard.harrington@bbsrc.ac.uk
Mark Taylor and Richard Harrington, Rothamsted Research
Rosemary Collier, HRI, Wellesbourne
Jon Pickup, SASA, East Craigs

Aphid news 4th July 2003

A warm and thundery week resulted in reasonable conditions for aphid flight during bulletin week 11: 23/6 – 29/6. The table below shows accumulated numbers for five species at traps in England for this year compared to last year and to a ten – year mean.

ACCUMULATED FIGURES UP TO WEEK 23/6-29/6 [* Silwood is only a three year mean 2000 - 02.]

	B.brassicae			C.aegopodii			M.euphorbiae			M.persicae			N.ribisnigri		
	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02
N	0	0	0	71	162	49	**15**	12	7	2	2	7	1	0	0
AB	12	22	112	351	403	354	16	18	22	**62**	22	27	**3**	0	0
P	10	0	9	251	327	595	**35**	5	23	**31**	9	18	**5**	2	2
K	5	9	153	139	837	649	28	21	36	**56**	17	31	2	3	3
BB	32	29	309	126	636	529	35	18	42	**494**	150	166	0	3	1
H	276	7	332	9	452	356	**51**	17	42	**65**	30	58	0	0	1
RT	67	11	216	45	327	243	6	17	37	92	42	134	0	2	2
WR	103	29	1084	93	258	344	47	20	81	319	104	341	2	2	3
SP*	**31**	8	21	14	196	182	17	12	28	**36**	16	15	4	3	3
W	77	11	169	75	343	288	22	21	30	**125**	68	121	0	1	2
SX	33	30	61	25	255	280	38	35	41	34	59	42	**4**	5	3

The numbers of **peach – potato aphid**, *Myzus persicae*, remain high throughout most of England, with a continued hotspot at Broom's Barn. The *M. persicae* tested up to 22nd June contained 1 MACE individual at Broom's Barn. Also five *M. persicae* tested showed R2 esterase resistance (Hereford 1/6, Broom's Barn 2/20 and Kirton 2/4). The latest water trap figures from the sugar beet growing areas demonstrated a minor fall in flight activity for *M. persicae* (389 compared to previous week's 406). The water trap figures for the **potato aphid**, *Macrosiphum euphorbiae*, showed a slight increase on the previous week (55 compared to 23), particularly in the West Midlands. The suction trap figures did not change much, but are most active in the midlands.

The numbers of **cabbage aphid**, *Brevicoryne brassicae*, in the suction traps this week rose slightly in central and southern England, but remain well below the accumulated ten year mean in most places.

The flight of the **willow – carrot aphid**, *Cavariella aegopodii*, has all but stopped, and the **currant – lettuce aphid**, *Nasonovia ribisnigri*, was caught only at Preston and Silwood Park.

The numbers of the **black bean aphid**, *Aphis fabae*, continued to increase in the suction trap catches throughout England. There was a very hot spot at Starcross, Devon, where over 1000 individuals were caught this week!

Summary and actions: Monitoring the **peach – potato aphid**, *M. persicae*, and the **black bean aphid,** *Aphis fabae*, across a range of crops should prove worthwhile. However, reports of increased activity of both aphid predators (in particular two spot ladybirds) and aphid parasitoids, and the recent inclement weather should begin to take their toll soon. Please feed back any information on aphids in crops, and **especially any instances of control failure**. You can also view aphid data bulletin 11: 23/6 – 29/6 at http://www.rothamsted.bbsrc.ac.uk/insect-survey/.

Mark-s.taylor@bbsrc.ac.uk and Richard.harrington@bbsrc.ac.uk
Mark Taylor and Richard Harrington, Rothamsted Research
Rosemary Collier, HRI, Wellesbourne
Jon Pickup, SASA, East Craigs

Aphid news 11th July 2003

A warm and wetter than average week, resulted in mixed conditions for aphid flight during bulletin week 12: 30/6 – 6/7. The table below shows accumulated numbers for five species at traps in England for this year compared to last year and to a ten – year mean.

ACCUMULATED FIGURES UP TO WEEK 30/6-6/7 [* Silwood is only a three year mean 2000 - 02.]

	B.brassicae			C.aegopodii			M.euphorbiae			M.persicae			N.ribisnigri		
	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02
N	0	0	0	**72**	171	55	**21**	12	9	9	4	9	1	0	0
AB	22	31	193	355	409	389	22	18	44	**90**	28	44	**3**	2	1
P	10	0	14	255	334	615	**35**	5	28	**31**	11	27	**7**	2	2
K	5	10	309	141	841	724	30	21	67	62	17	71	2	4	4
BB	42	32	595	130	638	566	43	18	63	**550**	159	388	2	3	2
H	282	12	633	9	476	382	53	17	72	69	31	81	0	0	1
RT	113	13	446	45	329	262	10	18	54	120	43	314	0	3	2
WR	235	33	2275	93	264	379	51	20	100	403	104	821	4	2	3
SP*	**61**	9	52	16	202	189	17	13	33	**64**	16	27	4	3	4
W	203	11	261	79	345	311	24	21	43	203	68	257	2	1	2
SX	43	44	92	25	268	294	48	36	49	40	81	56	**8**	6	4

The numbers of **peach – potato aphid**, *Myzus persicae*, decreased this week, and may have passed their peak flight for this year. The *M. persicae* tested up to 29th June contained 4 MACE individuals (Broom's Barn 3/30 and Writtle 1/19). Also two *M. persicae* tested showed R2 esterase resistance (Rothamsted1/10 and Broom's Barn 1/30). The latest water trap figures from the sugar beet growing areas demonstrated an overall decline in flight activity for *M. persicae*, with the exception of a few hotspots in the East Midlands. Both the suction trap and water trap figures for the **potato aphid**, *Macrosiphum euphorbiae*, are low and falling, but are most active in the west midlands.

The numbers of **cabbage aphid**, *Brevicoryne brassicae*, in the suction traps this week rose slightly, especially in south east England, but remain well below the accumulated ten year mean in most places. The **pea aphid**, *Acyrthosiphon pisum*, also continues to fly, particularly in south east England.

The numbers of the **currant – lettuce aphid**, *Nasonovia ribisnigri*, are above the accumulated ten year mean in two of the western sites, Preston and Starcross.

The **main mover** this week was the **black bean aphid**, *Aphis fabae*, which continued to increase in the suction trap catches throughout England. The suction trap at Starcross, Devon, remained a dramatic hotspot, with over 2500 individuals caught this week!

Summary and actions: The **black bean aphid,** *Aphis fabae*, is now likely to be conspicuous across a wide range of crops. Continued reports of aphid predators, aphid parasitoids and some fungal infection of aphids, suggest nature will eventually take control. Please feed back any information on aphids in crops, and **especially any instances of control failure**. You can also view aphid data bulletin 12: 30/6 – 6/7 at http://www.rothamsted.bbsrc.ac.uk/insect-survey/.

Mark-s.taylor@bbsrc.ac.uk and Richard.harrington@bbsrc.ac.uk
Mark Taylor and Richard Harrington, Rothamsted Research
Rosemary Collier, HRI, Wellesbourne
Jon Pickup, SASA, East Craigs

Aphid news 18th July 2003

'Some like it hot, some do not' – a very warm week, saw a slight increase in aphid flight during bulletin week 13: 7/7 – 13/7. The table below shows accumulated numbers for five species at traps in England for this year compared to last year and to a ten – year mean.

ACCUMULATED FIGURES UP TO WEEK 7/7-13/7 [* Silwood is only a three year mean 2000 - 02.]

	B.brassicae			C.aegopodii			M.euphorbiae			M.persicae			N.ribisnigri		
	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02
N	0	1	2	**74**	175	64	**24**	13	12	10	5	16	**1**	0	0
AB	46	47	605	359	417	410	30	19	66	**162**	28	88	**3**	3	1
P	16	0	16	255	337	631	**37**	5	34	31	11	33	**7**	2	2
K	11	13	417	147	846	756	64	21	107	74	17	136	4	4	5
BB	130	38	967	134	638	578	63	18	77	**614**	160	585	2	4	3
H	356	19	757	11	488	387	65	19	85	79	32	102	2	0	2
RT	231	19	714	49	331	267	18	19	60	176	46	405	2	4	3
WR	329	37	2540	93	265	386	55	20	113	439	105	893	4	2	4
SP*	**109**	12	54	20	204	190	17	14	34	**80**	16	27	4	3	6
W	**319**	11	295	79	348	317	26	21	48	251	70	297	2	1	3
SX	51	61	110	25	272	300	**60**	36	56	44	97	63	**8**	6	6

The numbers of **peach – potato aphid**, *Myzus persicae*, decreased in the south this week, but showed a slight increase in the midlands and the north. The *M. persicae* tested up to 6th July contained a further 8 MACE individuals (Rothamsted 2/8, Broom's Barn 3/15 and Writtle 3/22). Also five *M. persicae* tested showed R2 esterase resistance (Rothamsted 1/8, Broom's Barn 1/15 and Writtle 3/22), and one tested R3 at Writtle. The latest water trap figures from the sugar beet growing areas showed a marked decline in flight activity for *M. persicae* (85 compared to the previous week's 471). Both the suction trap and water trap figures for the **potato aphid**, *Macrosiphum euphorbiae*, are low with just a little flight activity in the East Midlands.

The numbers of **cabbage aphid**, *Brevicoryne brassicae*, in the suction traps this week rose in central and southern England, but remain well below the accumulated ten year mean in most places.

The small numbers of the **currant – lettuce aphid**, *Nasonovia ribisnigri*, are slightly above the accumulated ten year mean in the north and the south west, but please note, we only ever catch small numbers of this species in the suction traps.

The **black bean aphid**, *Aphis fabae*, continued to fly throughout England, with the suction trap at Starcross, Devon, again catching over 1000 individuals this week! However, the **main mover** this week appears to be the **grain aphid**, *Sitobion avenae*, coming off rapidly ripening cereals.

Summary and actions: Recent reports of aphid predators, in particular **hoverflies**, aphid parasitoids and some fungal infection of aphids, confirm nature is taking control. However, the **black bean aphid**, *Aphis fabae*, remains sporadically conspicuous across a wide range of crops. Please feed back any information on aphids in crops, and **especially any instances of control failure**. You can also view aphid data bulletin 13: 7/7 – 13/7 at http://www.rothamsted.bbsrc.ac.uk/insect-survey/.

Mark-s.taylor@bbsrc.ac.uk and Richard.harrington@bbsrc.ac.uk
Mark Taylor and Richard Harrington, Rothamsted Research
Rosemary Collier, HRI, Wellesbourne
Jon Pickup, SASA, East Craigs

Aphid news 25th July 2003

Inclement weather saw the number of aphids of horticultural importance drop markedly during bulletin week 14: 14/7 – 20/7. The table below shows a direct comparison of figures for this week with the same week last year and to a ten year mean for the same week.
(**NOTE** – this is not the accumulated totals table shown in previous weeks, but actual numbers for this week alone.)

FIGURES FOR WEEK 14/7-20/7 [* Silwood is only a three year mean 2000 - 02.]

	B.brassicae			C.aegopodii			M.euphorbiae			M.persicae			N.ribisnigri		
	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02
N	2	6	1	1	6	10	4	2	4	9	3	7	0	0	0
AB	12	3	27	2	1	16	10	0	25	2	1	11	0	0	1
P	6	0	2	0	3	8	6	0	9	4	1	6	0	0	0
K	6	6	69	8	2	9	14	0	22	12	2	31	0	0	3
BB	4	8	32	2	2	2	**12**	1	8	16	2	60	0	0	1
H	**212**	3	139	0	3	3	**18**	0	12	8	0	28	0	0	1
RT	26	7	109	0	1	2	2	0	7	2	1	62	0	1	1
WR	2	10	24	0	1	5	4	0	13	8	6	74	0	0	1
SP*	**26**	3	5	0	1	1	**4**	0	0	2	0	1	0	0	0
W	**50**	4	22	2	2	2	4	0	3	20	3	30	0	0	1
SX	8	12	20	0	5	2	2	0	4	0	5	7	0	1	2

Few **potato aphids**, *Macrosiphum euphorbiae*, or **peach – potato aphids**, *Myzus persicae*, were caught in the suction traps this week. The *M. persicae* tested up to 13th July contained a further 4 MACE individuals (Kirton 1/3 and Broom's Barn 3/18). The latest water trap figures from the sugar beet growing areas also showed a decline in flight activity for both *M. persicae* (14 compared to the previous week's 85) and *M. euphorbiae* (5 compared to the previous week's 12).

The **cabbage aphid**, *Brevicoryne brassicae*, appears to be active in south east England, and also particularly at Hereford.

Very few **willow – carrot aphids**, *Cavariella aegopodii*, and no **currant – lettuce aphid**, *Nasonovia ribisnigri*, were caught in the suction traps this week.

The numbers of the **black bean aphid**, *Aphis fabae*, crashed throughout the country this week, even at Starcross, where we have caught over 5000 in the last month.

The **main movers** this week continue to be the cereal aphids coming off cereals. The **grain aphid**, *Sitobion avenae*, and, more recently, the **bird cherry – oat aphid**, *Rhopalosiphum padi* in particular, are now dominating the suction trap catches.

Summary and actions: Activity of winged aphids of horticultural importance is now low and falling across the board. The predators really seem to have done their bit in recent weeks. We would, as always, be interested in field reports to confirm or refute this. You can also view aphid data bulletin 14: 14/7 – 20/7 at http://www.rothamsted.bbsrc.ac.uk/insect-survey/.

Mark-s.taylor@bbsrc.ac.uk and Richard.harrington@bbsrc.ac.uk
Mark Taylor and Richard Harrington, Rothamsted Research
Rosemary Collier, HRI, Wellesbourne
Jon Pickup, SASA, East Craigs

Aphid news 1st August 2003

The number of flying aphids of horticultural importance dropped still further during bulletin week 15: 21/7 – 27/7. The table below shows a direct comparison of figures for this week with the same week last year and to a ten year mean for the same week. (**NOTE** – this is not the accumulated totals table shown in previous weeks, but actual numbers for this week alone.) Aphid flights thus seem to be ending rather earlier than usual, but at a similar time to last year.

FIGURES FOR WEEK 21/7-27/7 [* Silwood is only a three year mean 2000 – 02 and NA=not available.]

	B.brassicae			C.aegopodii			M.euphorbiae			M.persicae			N.ribisnigri		
	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02	2003	2002	93-02
N	0	NA	1	0	NA	3	0	NA	3	1	NA	3	0	NA	0
AB	4	NA	15	0	NA	3	0	NA	25	2	NA	8	0	NA	0
P	**6**	NA	1	2	NA	1	0	NA	11	0	NA	4	0	NA	1
K	6	9	15	2	1	4	0	0	15	0	0	23	0	0	0
BB	0	16	30	0	0	1	0	2	13	0	0	99	0	0	0
H	2	10	88	2	6	2	10	2	10	2	2	14	0	0	0
RT	0	8	32	0	0	1	2	1	3	2	1	58	0	3	1
WR	2	10	13	0	0	1	8	2	24	0	2	228	0	0	0
SP*	2	1	3	0	4	1	2	1	0	0	0	1	0	0	0
W	10	5	13	2	0	2	0	0	11	0	2	46	0	0	1
SX	2	19	20	0	8	4	0	3	6	0	4	7	0	2	1

The **main movers** this week continue to be aphids coming off cereals. The **grain aphid**, *Sitobion avenae*, and the **bird cherry – oat aphid**, *Rhopalosiphum padi* dominate the suction trap catches.

Summary and actions: The summer flights of horticultural aphids are virtually over. Thus we propose this to be the last aphid news sheet for 2003. We will of course inform you immediately if anything relevant occurs later in the year. We will continue to e-mail you the aphid data bulletin, as well as updating the version that can be viewed at http://www.rothamsted.bbsrc.ac.uk/insect-survey/.

Mark-s.taylor@bbsrc.ac.uk and Richard.harrington@bbsrc.ac.uk
Mark Taylor and Richard Harrington, Rothamsted Research
Rosemary Collier, HRI, Wellesbourne
Jon Pickup, SASA, East Craigs

Aphid News Update 29th September 2003

The **peach – potato aphid**, *Myzus persicae*, has been notably prominent during September at two of the suction trap sites in England. The trap at Starcross, in Devon has caught some 51 individuals up to 18th September, and the trap at Kirton , Lincs, 127 individuals up to the 21st September. Of the 17 *M.persicae* tested from Kirton, 9 have tested positive for MACE resistance. Also four of the 17 showed R2 esterase resistance. These mechanisms confer resistance to pirimicarb/triazamate and organophosphate insecticides respectively. Growers should therefore be vigilant for control failures associated with applications of these compounds.

Aphid News Update 10th October 2003

At the beginning of each autumn, the **peach–potato aphid** (*Myzus persicae*) tends to be found in increasing numbers on the wing and in field crops. However, this year they appear to be notably prominent. So far, *M. persicae* have been caught in large numbers in suction traps in Lincolnshire, Herefordshire and Devon. From suction trap samples collected between 15th and 28th September 2003, a total of 167 *M.persicae* have been tested for resistance. The MACE form of resistance has been found in 2/17 at Writtle, Essex, 55/106 at Kirton, Lincs., 1/8 at Broom's Barn, Suffolk and 7/32 at Hereford. This form of resistance confers immunity to pirimicarb and triazamate. Furthermore, esterase-R_2 and R_3 resistance, which confers resistance to OPs and some carbamates, has also been present at significant frequencies in these suction-trap samples. In conjunction with this, there are growing numbers of reports from the UK and Ireland of difficulties in controlling *M. persicae* on brassicas and oilseed rape using a wide range of insecticides, which is most probably being caused by insecticide resistance. This is supported by information gained from live samples collected directly from Brussels sprouts in Yorkshire and Cambridgeshire. These have shown the presence of high levels of MACE and esterase (R_2/R_3). Where control problems are being encountered, particularly on Brussels sprouts, the use of pymetrozine (Plenum) is available as a new SOLA for brassicas. Recent feedback from growers and advisors suggests that this insecticide is controlling *M. persicae* well, although it tends to take a few days longer to work. In contrast, control of insecticide-resistant *M. persicae* on oilseed rape is likely to be difficult as pymetrozine is not available for use on this crop.

APPENDIX 2

INFORMATION SHEETS ON APHIDS OF HORTICULTURAL IMPORTANCE

Pea aphid *Acyrthosiphon pisum*

Appearance
The adult wingless form is rather large, at 2.5 - 4.4mm long, and usually either pale green or pink. It has long slender appendages, including two long pale slender tubes [siphunculi] at the rear end and a long pale tail [cauda]. The winged form is also large at 2.3 - 4.3mm long.

Host plants/Life cycle
This aphid spends all year living on leguminous plants. Eggs and active forms overwinter low down on various clovers, lucerne, sainfoin and trefoils. The eggs hatch in February and March, and winged forms are produced during May, which then migrate to peas and other legumes. Numbers usually reach a peak in late June and early July, although populations can remain noticeable on successive sowings of peas through to early autumn. There is a small autumn migration in late September back to the overwintering sites.

Pest status/damage
This aphid is generally a moderate pest on peas, only occasionally causing major damage. It causes direct feeding damage by feeding on the young growing points of peas, causing stunting, and subsequent distortion and yellowing of leaves and pods. The crops beginning to flower are most susceptible, especially if this coincides with the population peak in late June/early July. Heavy infestation on culinary peas can significantly reduce yields. This species also merits pest status because of its ability to transmit more than 30 plant viruses, in particular Pea leaf roll virus, Pea enation mosaic virus, Pea mosaic virus and Pea seed borne mosaic virus. It is also known to cause economic damage to field beans by the transmission of Bean leaf roll virus.

Black bean aphid *Aphis fabae*

Appearance

The adult wingless form is 1.5 - 3.1mm long, usually sooty black or very dark olive green, with some individuals having distinct white waxy stripes on the upper surface of the abdomen. The two tubes [siphunculi] at the rear end are black, short and tapering slightly towards the tip. The tail [cauda] is black, blunt finger shaped and short. The antennae are about half the length of the body. The winged form is 1.3 - 2.6mm long, also very dark, with some barely discernible black cross-bars on the upper surface of the abdomen.

Host plants/Life cycle

This species overwinters mainly as eggs on spindle, *Euonymus europaeus,* and occasionally in the south in the mobile stages on leguminous weeds or winter beans. The eggs hatch from late February to early April and colonies develop on young leaves and shoots. The winged forms are produced in May/June, and these migrate to an enormous range of summer hosts. This species has been recorded on almost 300 plant species. The principal commercial crops involved are field beans, broad beans and sugar beet, as well as most forms of garden bean. Some common summer wild hosts include docks, poppies, goosefoot and fat hen. Breeding continues throughout the summer, and further winged forms are produced in response to crowding, and these spread within crops and invade new crops. The populations usually peak in July/August, and are often noticeably attended by ants. In autumn *A. fabae* migrates back to *E. europaeus* and winter eggs are laid.

Pest status/damage

This species is a major pest on beans and sugar beet, occasionally at an epidemic scale, principally by causing direct feeding damage. The plants lose vigour, flowers are damaged and pod development in beans may be retarded or even prevented. Spring sown field beans can be damaged severely with considerable loss of yield. However, winter and early sown spring crops are less likely to be seriously affected, because plants are well established and flowering has finished before the aphid attack starts. In sugar beet very dense colonies can develop during the summer, causing significant wilting and poor growth. This species is known to transmit more than 30 viruses, mainly of the non-persistent variety. Large populations can cause significant secondary spread, even when it did not provide the initial primary infection. A by-product of such large colonies of aphid is contamination of the plant surface with sticky secretions, which promote the growth of sooty moulds. This superficial damage can reduce the sales value of the horticultural bean crops.

Glasshouse - potato aphid *Aulacorthum solani*

Appearance

The adult wingless form is 1.5 - 3.0mm long and has a pear-shaped body. It appears shiny and can be variable. It can be whitish green or yellow, in which case there is a bright green or rust coloured spot at the base of each siphunculus. It can also be uniformly dull green or greenish brown. The legs are long with dark knee joints. There are two tubes [siphunculi] at the rear, which are long with black tips flared at the very end. The antennae have dark joints and are slightly longer than the body. The winged form looks quite different, with much darker antennae, legs and siphunculi. It has a variably developed pattern of transverse dark bars on the upper surface of the abdomen. The winged form is also 1.5 - 3.0mm long.

Host plants/Life cycle

This aphid has the unusual ability of overwintering as eggs on many different host plant species. However, the majority of the population overwinters in the mobile stages, particularly on potato sprouts in stores/chitting houses and on many plants under glass. Winged adults migrate in late spring and start colonies that reach a peak in July. This species is extremely polyphagous, colonising over 200 plant species, including both dicotyledons and monocotyledons, but not Gramineae. There is a very small autumn migration back to winter hosts.

Pest status/damage

This species is a minor pest on field crops, especially potatoes, but rarely causes significant direct feeding damage. Although it has the ability to vector about 40 viruses, both persistent and non-persistent, its relatively poor transmission efficiency makes it unimportant as a virus carrier in the field. However, this aphid's importance increases when found on protected crops and glasshouse plants. It is a problem particularly on ornamentals, bulbs [especially tulips] and a wide range of 'house' plants.

Leaf-curling plum aphid *Brachycaudus helichrysi*

Appearance

The adult wingless form is 0.9 - 2.0mm long. The spring populations are very variable, ranging from yellow to green to brown, often shiny with a slight wax dusting. In the summer forms on herbaceous plants, as well as yellow and green, they can be almost white/pinkish. The two tubes [siphunculi] at the rear end are pale, very short and tapered. The tail [cauda] is pale, short and blunt. The antennae are shorter than the body with dusky tips. The winged form is 1.1 - 2.2mm long, with dark antennae, legs and siphunculi. The tail is blunt and somewhat less dark. The upper surface of the abdomen has a broad dark patch formed by more or less fused cross-bars.

Host plants/Life cycle

The overwintering eggs are laid on various *Prunus* spp., particularly plums (*P. domestica*) and damsons (*P. insititia*). Unusually these eggs hatch early in November/December and the subsequent nymphs then feed on dormant buds. In spring successive generations feed on young foliage, until in May winged forms migrate to numerous summer hosts. They have been recorded on some 120 plant species, with a notable preference for Compositae such as asters, chrysanthemums, yarrow and groundsel. The migration from winter host to summer host is usually complete by early July. The return migration to *Prunus* spp. begins in the latter half of August and continues to mid October.

Pest status/damage

This aphid is a pest on *Prunus* spp. cause leaves to roll up tightly perpendicular to the mid-rib, thus severely damaging leaves at a time of rapid growth, and so early as to be before natural enemies are active. This species is able to transmit a number of viruses including Plum pox virus, Cucumber mosaic virus, Dahlia mosaic virus, and a mosaic virus disease of cineraria. It is also a notable pest of glasshouse crops and house plants. Although a relatively poor vector of Potato virus Y, a non-persistent virus, it can in some years fly in such large numbers as to become an important vector even on potato crops, which it does not truly colonise. A similar role for this species has been insinuated in the sugar beet crop with respect to its infection by non-persistent Beet mosaic virus.

Mealy cabbage Aphid *Brevicoryne brassicae*

Appearance

The adult wingless form is 1.6 - 2.6mm long, greyish green, with a body covering of greyish white mealy wax. This species has a pair of short 'barrel' shaped tubes [siphunculi] at the rear of the abdomen, and a triangular tail [cauda]. The winged form is 1.6 - 2.8mm long, with short black transverse bars on the upper side of the abdomen. The wing vein nearest the abdomen on the forewing is darker and thicker than the other veins.

Host plants/Life cycle

This aphid is restricted to herbaceous Brassicaceae (Cruciferae) throughout its life cycle, because it requires the presence of mustard oil, sinigrin, to initiate a feeding response. The shiny black eggs are placed on the stems and leaves of cruciferous crops that remain in the field through the winter e.g. oil seed rape or overwintering horticultural brassica crops. These eggs hatch sometime between February and April, producing young that feed on leaves and shoots. Winged forms produced in May-July migrate to newly planted brassica crops, where numbers can increase rapidly. An early summer peak in abundance is reached between mid-July and mid-August, followed by a population crash brought about by a range of natural agents. A further migration from mid-September to mid-October results in egg laying in October. In recent years, more of the population has spent the winter as mobile stages, not eggs. These individuals, if they survive, have a head start in warm springs over the young hatching from eggs. In this species there is considerable variation in the annual pattern of infestation.

Pest status/damage

This aphid is a major pest on broccoli, cabbage, cauliflower, kohl rabi, radish and swede. It causes serious feeding damage, leaving plants weakened and stunted, and heavily infested seedlings and young plants can wilt and die. Less serious distortion and fouling of leaf surfaces reduces marketability. It attacks oil seed rape and kale to a lesser extent, and turnips appear virtually immune. This species can transmit about twenty plant viruses, of which Cauliflower mosaic virus and Turnip mosaic virus are most important.

Willow – carrot Aphid *Cavariella aegopodii*

Appearance

The adult wingless form is 1.0 - 2.6mm long, green or yellowish-green, elongate oval and somewhat flattened. There are two tubes [siphunculi] at the rear end, which are swollen towards the tips. A small outgrowth [∠ tubercle] is present above the tail [cauda]. The winged form is 1.4 - 2.7mm long, darker and more easily seen because of a black patch on the upper surface of the abdomen, formed by the fusion of three or four cross bars.

Host plants/Life cycle

This aphid principally overwinters as eggs round bud axils of willows [*Salix* spp.], in particular crack willow (*S. fragilis*) and white willow (*S. alba*). Eggs on willow hatch in February or March, with the young feeding first on young shoots, then on foliage and catkins, where colonies develop. Winged forms produced in May migrate to carrot, parsnip, celery, parsley or other umbelliferous plants over a 5-6 week period, usually with a peak in early June. Late seasons can delay migration for 2-3 weeks, but generally populations on summer hosts peak in late June and then decline. Further winged generations disperse to hedgerow umbellifers, and finally back to willow in the autumn to mate and lay eggs. A small proportion in warmer areas can survive winter as mobile stages on umbelliferous plants or on carrots in field storage, e.g. under straw, and produce colonies early the following spring.

Pest status/damage

This aphid is a major pest on carrots, celery, parsnips and parsley. It often causes considerable loss of yield in carrot crops sown in April/May, but those sown in June may escape attack. Dry sunny weather late May/June favours a large-scale migration to host crops, but cold rainy weather inhibits it. The aphids infest carrots at the cotyledon stage, but can also invade older plants. When many are present the leaves may be discoloured, distorted and sometimes shiny from honeydew excretion. The plants and ground below may become covered with cast skins. This aphid is a vector of the Carrot motley dwarf virus complex, which produces a yellow mottling of the leaves and stunts the plants. It also transmits Parsnip yellow fleck virus, which can cause severe damage, stunted plants and blackening of the central core. It is also known to transmit Carrot red leaf virus, Parsnip mosaic virus and Celery mosaic virus. Damage may be confused with carrot fly attack and sometimes drought stress, which produces similar foliar symptoms.

Mealy plum aphid *Hyalopterus pruni*

Appearance

The adult wingless form is a small to medium sized aphid 1.5 - 2.6mm long, and has an elongate shape. It is usually pale green with a fine darker green mottling. Most individuals are covered with a white wax meal. The antennae are between 0.5 - 0.75 times the body length. The two tubes [siphunculi] at the rear end are very short, thickening and growing darker towards the apex. The tail [cauda] is longer, 1.5 - 3.0 times the length of the siphunculi. The winged form is a similar size, green with white wax patches on the upper surface of the abdomen. The siphunculi are sometimes only dark on the apical third.

Host plants/Life cycle

The eggs of this species overwinter on *Prunus* spp., mainly plums, but also peaches, apricots and almonds. The eggs hatch in April, usually by the white bud stage on plum, where colonies can build rapidly to literally 'pave' the underside of the leaves. The winged forms of this species develop later than those of the other aphid pests on plum (*Brachycaudus helichrysi* and *Phorodon humuli*), and migrate to waterside grasses and reeds from the beginning of June. The population on plum continues to increase through July, with the peak of migration occurring between early July and early August. The return migration to *Prunus* spp. begins in September, and is usually quite small. Some aphids of this species are known to remain on plum, the winter host, all the year round.

Pest status/damage

This aphid is only a pest on its winter hosts, in particular plums. When it occurs in large numbers on young leaves it causes significant feeding damage, but apparently does not cause leaf curling. It combines this damage with excreting honeydew onto lower leaves, which become dark with sooty moulds growing in the resulting sticky film. These fungi reduce the plant's ability to photosynthesise. This species is 'weak' vector of Plum pox potyvirus.

Blackcurrant - sowthistle aphid *Hyperomyzus lactucae*

Appearance

The adult wingless form is medium sized, about 2.0 - 3.2mm long, and broadly spindle shaped. These aphids are an opaque green, with pale legs, siphunculi and cauda, but the tips of the antennal segments are dark. The two tubes [siphunculi] at the rear end are pale, medium to long and distinctly swollen. The tail [cauda] is shorter than the siphunculi, finger shaped with a somewhat blunt ending. The winged form is a very similar size, but has a rather broken central dark patch on the upper surface of the abdomen. The antennae are black, and the legs and siphunculi are a medium pigmented brown. The tail remains a pale colour.

Host plants/Life cycle

The eggs of this species overwinter on *Ribes* spp., in particular blackcurrants, but occasionally other species including redcurrants. The eggs hatch in March and early April, spring colonies developing in the apices of young shoots. Few winged forms develop in the second generation, but more appear in the third generation and these migrate in late May/June to *Sonchus* spp., especially sowthistle. On sowthistle, colonies reproduce and build up, and can be found on the upper parts of stems and on the inflorescences. There is evidence to suggest some migration between the summer hosts in July and August. The return migration to *Ribes* spp., takes place in September and October.

Pest status/damage

The species causes problems primarily on its winter host, blackcurrant. Colonies found on currants cause leaves to curl downward, stunting young growth. It is also common for leaves to acquire yellow spots resulting from aphids feeding. This species is a proven vector of some 12 non-persistent and semi-persistent viruses, but none apparently infect currants. It is known to have the ability to transmit the persistent virus, Lettuce necrotic yellows virus, but does not colonise lettuce!

Potato aphid *Macrosiphum euphorbiae*

Appearance

The adult wingless form is large 1.7 - 3.6mm and an elongated pear shape. It ranges from light green, yellowish green to pinkish red. It often has a darker stripe down the centre of its back, especially in immature nymphs. This species has noticeably long legs, and two long tubes [siphunculi] at the rear end. The tail [cauda] is also long and finger shaped. The winged form is 1.7 - 3.4mm long, with a much less distinct central stripe. The antennae and siphunculi are darker than in the wingless forms.

Host plants/Life Cycle

This species overwinters rarely as eggs on *Rosa* spp., but predominantly spends winter in the mobile stages on weeds, potato sprouts in stores/chitting houses, and on lettuce under glass. In early May/June winged forms are produced and migrate to potato and other crops. This aphid is highly polyphagous in the summer, feeding on over 200 plant species in more than 20 plant families. The Solanaceae, especially potato, are its preferred summer hosts. A second summer dispersal migration in July may happen if numbers are particularly high. There is only a very small migration in the autumn.

Pest status/damage

In some years this species is a major pest on potatoes and lettuce, both outdoor and indoor. It is of little importance in the field as a virus vector of potato viruses. It can cause physical damage to foliage resulting in yield loss when populations are high. Early large infestations may cause the upper leaves of some potato varieties to roll upward [false top roll]. It can transmit over 50 plant viruses, mainly of the non-persistent variety, but with less efficiency than *Myzus persicae*. In particular it is known to transmit Potato leaf roll virus (symptoms appear later than false top roll), Beet mild yellowing virus, Beet yellows virus and Lettuce mosaic virus. In lettuce crops small numbers can persist late into autumn and will affect marketability.

Shallot aphid *Myzus ascalonicus*

Appearance

The adult wingless form is 1.1 - 2.2mm long, and shiny pale green to dirty yellow. Its appendages are all pale except for the ends of the antennae and the 'ankles/feet' which are all quite black. The two tubes [siphunculi] at the rear end are pale, short to medium in length with the apical part slightly swollen. The tail [cauda] is roughly triangular in shape and short, about a third the length of the siphunculi. The winged form is 1.3 - 2.4mm long, with a black abdominal patch on the upper surface, and some smaller separated markings on the lower surface. The siphunculi are black and again slightly swollen. It also has a black tail.

Host plants/Life cycle

This species is not known to produce overwintering eggs at all, but is extremely polyphagous, having been recorded on over 200 plant species from 20 plant families. Overwintering takes place in glasshouses and other protected places such as potato stores, on onions or shallots, or swede/beet clamps. It can also pass the winter in the open on plants such as chickweed and cranesbill under hedges or similar shady spots. This aphid seems quite cold hardy and apparently thrives on etiolated plants growing in the shade, where large numbers can build up even at low temperatures. Winged forms are produced in spring, and migrate from late April through to mid June. Plants colonised in the summer are many, but include crops such as onions, shallots, strawberries, lettuce, brassicas and potatoes. It is also known to infest many economically important garden ornamentals, such as asters, chrysanthemums and polyanthus, as well as most flowers derived from bulbs. There is a small flight in mid October most years.

Pest status/damage

This species is a particular pest on shallots and strawberries. It colonises strawberries in autumn, building up over winter to cause severe damage the following spring, distorting leaves and blossom, and even destroying whole crops after mild winters. This aphid is an important virus vector and is a proven transmitter of over 20 plant viruses, including Beet yellows virus, Potato leaf roll virus and a range of strawberry viruses. It seems particularly important for its ability to transfer viruses from wild overwintering hosts to crops e.g. Beet mosaic potyvirus from chickweed to sugar beet.

Peach - potato aphid *Myzus persicae*

Appearance
The adult wingless form is 1.0 - 2.1mm long, and varies considerably from yellow, through all shades of green, to pink, red and almost black. The two tubes [siphunculi] at the rear end of the abdomen are medium length and slightly swollen towards darkened tips. The winged form is 1.2 - 2.5mm long, with a black central abdominal patch on the upper surface, but a pale underside.

Host plants/Life cycle
The winter host is peach, *Prunus persica*, which is confined to small numbers in southern Britain. So, although some eggs overwinter on peach, overwintering is usually in the mobile stages on herbaceous plants, weeds and brassicas. The summer hosts are very numerous and spread over 40 plant families, and include very many economically important plants. Winged forms start to migrate from their winter hosts to fresh summer hosts from late April to early June. Numbers reach a peak in July. However this aphid does not form dense colonies, but tends to move when crowded by walking to infest other parts of the same or neighbouring plants. Redistribution in late summer to other crops or wild herbaceous plants is followed by a return migration to winter hosts in late September and early October.

Pest status/damage
This species is regarded as a major pest on potatoes, sugar beet, lettuce, brassicas and legumes. This is the most important pest and virus vector aphid in Britain due to its wide host range and its proficiency in transmitting more than 120 plant viruses. Its behaviour in not forming dense colonies means that it rarely reaches levels causing direct feeding damage. However, its tendency to walk short distances when crowded greatly enhances its importance as a virus vector. Some of the more important viruses transmitted include Potato leaf roll virus, Beet western yellows virus, Beet mild yellowing virus, Pea enation virus and Lettuce mosaic virus. Even small numbers cannot be tolerated when producing certified seed potato crops.

Currant - lettuce aphid *Nasonovia ribisnigri*

Appearance

The adult wingless form is 1.3 - 2.7mm long, green to yellowish green, even occasionally reddish. The abdomen is shiny with a dark green to black pattern on the upper surface. There are two long tubes [siphunculi] at the rear end, with pale bases but dark tips. The tail [cauda] is pale, finger shaped and about two-thirds the length of the siphunculi. The winged form is 1.5 - 2.5mm long, with black siphunculi and antennae, and with a conspicuous black abdominal pattern.

Host plants/Life cycle

The currant - lettuce aphid overwinters in the egg stage on currant or gooseberry bushes. These eggs usually hatch in March or April, nymphs then infesting the tips of the young shoots. Colonies are formed on the developing leaves, and in May or June winged aphids migrate to lettuce and other Asteraceae (Compositae). Successive generations are produced on these summer hosts until September or October. During October and November, winged aphids migrate back to the winter hosts, where eggs are laid. In southern Britain mobile stages can survive and slowly reproduce on outdoor lettuce, chicory, hawkweed and speedwell throughout mild winters.

Pest status/damage

This species is a pest on both its winter and its summer host. On its winter hosts *Ribes* spp. it causes leaf curl and retardation of growth. In mid August/September it is the most important foliage aphid on lettuce. Rapid development of colonies on lettuce causes plants to become stunted and unpalatable, indeed even small numbers can contaminate plants and affect marketability. In some cases large populations on young plants may prevent 'hearting'. This species acts as a vector of Gooseberry vein-banding virus, but apparently cannot transmit Lettuce mosaic virus.

Damson – hop aphid *Phorodon humuli*

Appearance

The adult wingless forms are small on their summer hosts, 1.1 - 1.8mm long, but medium sized on its winter hosts, 2.0 - 2.6mm long. They range from pale green to yellowish green, with darker green longitudinal stripes on the upper surface of the abdomen. The two tubes [siphunculi] at the rear end are pale, of medium length, thicker at their bases and slightly curved outwards at their tips. The tail [cauda] is short, pale and blunt. This species characteristically has a pair of sharply pointed head projections on the inside of the antennae. The winged form is 1.4 - 2.1mm long, and has a black patch of more or less fused cross bars on the upper surface of the abdomen. The projections on the head are much less developed in the winged form, and the tail more triangular and sharp.

Host plants/Life cycle

This species overwinters as eggs on *Prunus* spp., particularly on blackthorn, bullace, damson and plums. The eggs hatch between late February and April. After one or two generations of wingless aphids, winged forms begin appearing in the latter half of May. These winged forms migrate to the summer host, hops. This migration begins in earnest in early June and reaches a maximum in late June. It then declines and ends in late July or early August. It appears there is little movement within or between hops, and no further winged forms are produced until the autumn. A return flight to the winter hosts occurs in September and October. This species can stay on its winter host *Prunus* spp. throughout the summer, particularly on the sucker growth of plums.

Pest status/damage

On hops, this is the dominating pest species and is the main limiting factor to hop production. Routine pesticide application is required every year, at the very least at the beginning of the aphid flight. Heavy infestations reduce hop plant vigour and may induce defoliation. Even light infestations of the harvested hop cones can reduce their economic value. Added to this, it is able to transmit Hop mosaic carlavirus, Hop split leaf blotch virus and Hop line pattern virus. This species may also cause a little damage on plums, by curling young leaves and by transmitting Plum pox potyvirus.